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THE NEW CONSERVATION MOVEMENT WITH RESPECT TO PETROLEUM AND NATURAL GAS

BY CHARLES G. HAGLUND*

Conservation statutes having for their purpose the regulation of the taking of natural gas, date back into the early nineties. The object of the early legislation was to prevent the waste of gas by blowing it into the air¹ or by burning it from torches.² The statutes were designed to preserve the gas that its heat producing qualities might be utilized. Aside from surface waste these statutes were later designed to protect the oil and gas strata from water intrusion and to prohibit the manufacture of carbon black without utilizing the heat producing qualities of the gas. Generally there were state statutes relating to the plugging of abandoned wells.³ Carbon black statutes have been generally upheld⁴ as well as other statutes designed to regulate the use of gas. Statutes of the character in question are all sustained as valid enactments under the state police power if they are not unreasonable nor arbitrary. Although gas may be produced on private lands, and is private property, the general public has such an interest in it that its

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¹ Laws of Indiana, 1893, c. 36.

² Laws of Indiana, 1891, c. 47. *Townsend v. State*, 147 Ind. 624 (1897), sustained the statute forbidding the burning of natural gas in flambeau torches.

³ *Commonwealth v. Trent*, 117 Ky. 34 (1903). For a collection of such statutes see 43 Harv. L. Rev. 1137; 19 Cal. L. R. 416, and for a classification of such state conservation statutes see the comprehensive article of Veasey—Legislative Control of the Business of Producing Oil and Gas—52 Reports Am. Bar. Assn. 577, 588-602 (1927); Ford, Controlling the Production of Oil, 30 Mich. L. R. 1170, 1178-1190.

⁴ *Walls v. Midland Carbon Co.*, 254 U. S. 300 (1920); *Quinton Relief Oil & Gas Co. v. Corporation Commission* (Okla.), 224 Pac. 156, upheld an order of the commission based on the conservation statute prohibiting the sale of gas for the manufacture of carbon black; *contra*, *Gas Products Co. v. Rankin* (Mont.), 207 Pac. 993 (1922); *F. O. Henderson, Inc. v. Railroad Commission of Texas*, 56 F. (2d) 218 (1932), upholding the recent Texas conservation statute and prohibiting the plaintiff from allowing the gas to blow into the air after the gasoline had been extracted from it, would probably also prohibit gas being used for the manufacture of carbon black.

taking and use will be subject to state regulation under the police power. Then because of its migratory character adjoining landowners have an interest in the common source of supply which affords sufficient ground for the state to regulate their correlative rights by means of the police power.

The plight of the petroleum industry in recent years need not be recounted. The periodical literature is full of it.⁵ It has been repeated with the discovery of every new major pool in this country. In recent years because of improved scientific means of locating new pools and the improvement in drilling machinery which within the last five years have enabled wells of double the former depth to be reached,⁶ and due to the intensively competitive system prevailing in production, the output of petroleum has been out of all proportion to legitimate market demands and the former periodic overproduction has led to a constant supply in excess of market demands.

The property law under which the oil industry has operated permits the landowner to drill as many wells on his land as he pleases and reduce all the oil he can to possession through his wells irrespective of whether the oil comes from underneath his land or from beneath that of his neighbor.⁷ The adjoining owner had no legal or equitable remedies by way of damages or injunction to prevent his oil from being drained from underneath his land and being reduced to possession through the wells on the adjacent land. His only remedy was to drill offset wells on his own land and likewise reduce as much oil to possession as he could. Then the law of implied covenants compelled the lessee

⁵ Steel, *The Anti-Trust Laws and the Oil Industry*, 147 *Annals* 78 (1930); Hervey, *Anti-Trust Laws and Conservation of Minerals*, 147 *Annals* 67; Marcossou, *What Price The Sherman Law?*, *Sat. Eve. Post*, Feb. 21, 1931, p. 6; Barrows, *An Industry Drowning in a Flood of Laws*, *Am. Reviews of Reviews*, Nov., 1931, p. 58; articles cited herein after from *Oil and Gas Journal*, *Petroleum Production Bulletins*, *Petroleum Development and Technology*, etc. See also Veasey, *May the American Petroleum Industry Through Voluntary Action Meet Its Problem of Over-Production*, 10 *Mining and Metallurgy* 190 (1929); Leith, *What is the Policy of the Mineral Industry?*, *Petroleum Development and Technology* 1932, p. 13—nationalism since war has brought desire for self-sufficiency to all countries in regard to all raw materials and industries and has led to world-wide over-production.

⁶ In 1931 *Jardin No. 35* reached a depth of 10,585 feet, the deepest well in the world to date, Garfias, *Mexican Oil Production in 1931*, *Petroleum Development and Technology* 1932, p. 266.

⁷ *Summers, Oil and Gas*, Sec. 24 (1927).

to drill offset wells to protect the lessor from drainage under penalty of forfeiture of the lease if he failed to do so.

The result was that when a new major oil pool was discovered over which several landowners were located there always was a race started in which each landowner had to drill and reduce all of the oil he could to possession before it was drained away by those drilling on adjoining lands. This intensive drilling competition caused a flood of oil to be dumped on the market irrespective of whether there was any demand for it or not. A break in the price structure was the immediate consequence. Aside from the economic waste in falling prices, the pool was uneconomically developed. Many more wells were drilled than would be required to drain the pool if the wells had been properly spaced. Then under the unscientific and competitive method only a small part of the oil in the pool is recovered. And wells on a small and steady production in other fields cannot compete in the falling prices caused by the flush production from the new field and are hence forced to shut down.

When this early property law of capture was first evolved with respect to oil and gas the nature and behavior of these minerals within the earth were little understood. It was believed that they resembled percolating water in its movement from place to place, and consequently the law of percolating water was applied to oil and gas. The courts also saw a resemblance in the behavior of these minerals to that of wild game. In both the case of percolating water and that of wild game the courts had recognized and applied the law of capture and reduction to possession as proofs of ownership.

While the origin of oil pools is still obscure, the nature of them and the behavior of oil and gas therein are now well understood. The analogy of percolating water is known to be no longer applicable to them. Oil and gas pools are now found associated with sedimentary rock. While the origin of these minerals is undoubtedly to be found in animal and vegetable matter, chiefly the latter, deposited in the course of the formation of the sedimentary rock it still remains very obscure how the oil and gas have found their way from these sedimentary rocks

and collected in such enormous quantities as they are now found in many pools.⁸

The physical characteristics of an oil pool are now well known. Usually where they occur they are found in the folded anticlines of sedimentary strata. Or they may be found in tilted strata which have pinched out. The essential is an impervious layer of rock above to prevent escape. Gas, oil and water are then found arranged according to specific gravity. Above is the free gas zone, if any exists as such, below the gas is the oil, and below the oil and on the edges is found the water sheet. While the oil and gas are said to be contained in a reservoir in the sedimentary rock, the reservoir is in fact usually only porous sand and limestone. The sandstone pores are often very minute and often highly capillary in form. In these capillary pores are contained the large quantities of oil and gas found in pools at the present time. The oil and gas in the pool are stationary in nature, and it is only when the impervious layer of rock is pierced by the drill that the gas pressure within the pool causes migration of the oil and gas toward the well where the pressure is being released. Hence prior to any drilling the early conception of the migratory character of oil and gas entertained by the courts has been found to be erroneous.

The function of gas and the part that it plays in the production of oil and the underground waste resulting from the failure to recover the oil where the gas is allowed to escape into the air have only recently come to be understood. In 1926 the experiments of Beecher and Parkhurst as to the effect of gas dissolved in oil upon the viscosity and surface tension of oil were published.⁹ Their investigations revealed that where oil

⁸Ries, *The Origin of Petroleum*, Scientific American, Jan., 1929, p. 56; Oliver, *Oil and Gas Law Responsible for Overproduction and Waste*, 55 Reports Am. Bar Assn. 712 (1930).

⁹Beecher and Parkhurst, *Effect of Dissolved Gas Upon Viscosity and Surface Tension*, 25, 22 Oil and Gas Jour. (Oct. 21, 1926), p. 113; *Petroleum Development and Technology* 1926, p. 51. The problem demonstrated by Beecher and Parkhurst had been suggested by Henry L. Doherty who could only account for the enormous quantities of oil coming from large flush wells on the theory that oil in a pool must be radically different from that at the surface. See *Petroleum Development and Technology* 1932, p. 45, for Doherty's letter of July 3, 1925, to the Federal Oil Conservation Board. On this see also Snider, *Propositions and Corollaries in Petroleum Production*, *Petroleum Development and Technology* 1932, p. 51, 57; Hardwicke, *Legal Aspects of Gas Conservation in Oil Production*, A. P. I. Production Bulletin

and gas are in contact under great pressure a large volume of gas is dissolved in the oil. They found that at a pressure of 500 pounds per square inch and at a temperature of 70° F. natural gas such as is associated with oil will reduce the viscosity of the oil about 50 per cent. when the oil was saturated with gas. At pressure of 1800 pounds which would correspond to depths of 4100 feet they estimated that the viscosity of oil would be reduced to that of kerosene by the increased amount of gas held in solution.¹⁰ They also found that at pressures of 400 to 500 pounds the surface tension of the oil was reduced about 20 per cent. by the dissolved gas. It was also found that the lighter gravity oils dissolve more gas than the heavier oils and that rise in temperature of the oil decreased the solubility of the gas. At 400 pounds pressure and 90° F. 75 cubic feet of gas was dissolved in one barrel of oil, while at the same pressure at 110° F. 70 cubic feet of gas was dissolved in the same oil. But viscosity of oil will decrease with rise in temperature. The amount of gas dissolved in oil increases with pressure.

Since the oil in the rock reservoir is principally held in capillary pores in the sandstone, the great part that the gas plays in the recovery of oil becomes apparent. Not only will the gas pressure act as a gas-lift to raise the oil in the well, but by reducing the viscosity and surface tension it will enable the oil to move through the sand pores to the well. When a well is therefore allowed to produce only gas or oil at a too high gas-oil ratio the pressure in the reservoir is being reduced, the dissolved gas in the oil is released, the viscosity of the oil is increased, and the surface tension of the oil is increased. This prevents the oil from moving as readily through the sand pores where it will consequently remain in large quantities and be lost to recovery. Then where dry gas exists in the sands above the oil the blowing of gas and release of pressure has the effect of bringing the oil up into the dry sand where it will adhere and

No. 207, p. 23, *Oil and Gas Journal* 30, 6, p. 17 (6/25/31); Miller, *Function of Natural Gas in the Production of Oil*, p. 41, American Petroleum Institute.

¹⁰ The original gas pressure in a reservoir is known as rock pressure. This pressure increases about 40 pounds for every 100 feet of the depth of the well. Thus a 100 ft. well has 40 lbs. original rock pressure, 1000 ft. 400 lbs., 5000 ft. 2000 lbs., 6000 ft. 2400 lbs.; Oliver—*Oil and Gas Law Responsible for Overproduction and Waste*, 55 *Reports Am. Bar Asso.* 712 (1930).

be lost to recovery. It is estimated that if the surface tension were the only force, and if it could be reduced 20 per cent. by keeping the gas in solution, it would result in 80 per cent. greater ultimate recovery of oil from the sands.¹¹

An oil structure should not be drilled into the gas zone, and if it is the well should be shut in that the gas may remain in the reservoir and function in the production of oil. Wells should be sunk on the lower part of the structure into the oil zone where the gas pressure may be fully utilized in driving the oil to the well. The outer edges of the field should also be developed first, which will allow the edge water to move in uniformly and drive the oil before it. Wells that yield too high gas-oil ratio should be shut in and the oil taken from wells lower on the structure. All gas that is not necessarily used in the production of oil should be returned to the reservoir at key wells for repressuring the reservoir. If oil is properly produced, the original rock pressure should be maintained in the reservoir as nearly as possible until the pool is ultimately drained of oil. By allowing the gas to escape from the reservoir, as is the prevailing practice under competitive drilling, often 80 to 90 per cent. of the oil is lost to recovery.¹²

It thus becomes apparent that to control production from new pools and to avoid waste of oil by it remaining unrecovered in the ground and to avoid waste of gas and gas-pressure which are essential to the recovery of oil, an oil pool cannot be developed on the present competitive basis but must be developed as a unit, and the landowners over a pool must become tenants in common of the oil in the pool and of the reservoir energy which is so essential for the production of oil. To affect this change the old law of capture of oil and gas must be replaced by law which will recognize the correlative rights of the several surface owners over a pool in the common supply of reservoir energy and of the oil content in the pool in proportion to their several acreage contents. Each landowner is equitably entitled to all the oil beneath the surface of his land as it exists in the pool originally and to his proportionate share of the reservoir energy for the production of that amount of oil.

Recent developments, as will later appear, have already

¹¹ Beecher and Parkhurst, note 7, *supra*.

¹² Oliver, note 8, *supra*, pp. 713-720.

thrown the old property law of capture with respect to oil and gas very much into a state of flux, and the courts will undoubtedly in the course of time, even in absence of legislation, change the law of property in oil and gas so as to make it conform to existing scientific knowledge. Such change would only follow the law of growth to which the common law has always been subject when new facts have been discovered or new conditions have developed showing that the old law is no longer applicable to existing facts that have been revealed because of new knowledge.

This necessity for change in the law has been recognized with respect to the law of percolating water in many jurisdictions in this country. Under the old common law of England any landowner could take all of the percolating water in his land that he was able to reduce to possession, even if in doing so he drained his neighbor's well or spring, and his neighbor had no cause of action against him for destroying his well or spring because of capturing the percolating water on land adjoining his neighbor's land.¹³ This common-law rule has not found full acceptance in this country, where many jurisdictions have adopted the doctrine of reasonable use of percolating water.¹⁴ In the western and semi-arid states this doctrine has received especial recognition. The change in the law of percolating water is only one phase of the change of the common law by growth to adapt it to ever changing conditions and its application to new facts and circumstances.

Oil and gas are irreplaceable natural resources and as such are subject to regulation under the police power by the states. In the first leading case that came before the United States Supreme Court it was recognized that landowners have no such absolute property in gas as will enable them to waste it to the detriment of other owners of the common source of supply. The correlative rights of the various owners were shown to exist and these rights it was competent for the state to protect by legislation.¹⁵ This doctrine was reaffirmed in a case that up-

¹³ *Action v. Blundell*, 12 M. & W. 324 (1843).

¹⁴ *Meeker v. East Orange*, 77 N. J. L. 628 (1909); *Katz v. Walkingshaw*, 141 Cal. 116 (1903).

¹⁵ *Ohio Oil Co. v. Indiana*, 177 U. S. 190 (1900). Court says: "There is a co-equal right in them all to take from a common source of supply . . . The use by one (landowner) of his power to seek

held a New York statute forbidding the pumping of mineral waters holding carbonic acid gas in solution for the purpose of increasing the flow of the gas and vending the same as a commodity otherwise than in connection with the mineral water with which it was associated.¹⁶ The state court had construed this statute as applicable only where the waters were drawn from a common source of supply and if injury were done to others having a like right to resort to it. Accepting this construction, the United States Supreme Court sustained the statute. A Wyoming statute made unlawful the burning of natural gas from any well without the heat being fully utilized for other manufacturing or domestic purposes when the gas well or source of supply is located within ten miles of any incorporated town or industrial plant. This statute was sustained as against the plaintiffs which sought an injunction restraining enforcement against it.¹⁷ Prior to the enactment of the statute the corporation had erected a factory for the manufacture of carbon black at an expenditure of \$375,000, and which factory was located less than the specified distance from an incorporated town, but without fully and actually utilizing the heat from the burning of the gas as required by the statute. The court concludes the police power is legitimately exerted to prohibit an extravagant or wasteful or disproportionate use of the natural gas of the state and the plaintiff corporation is not deprived of property without due process of law.

These cases must be taken to have conclusively settled that a state has the right by virtue of its police power to regulate the production and use of oil and gas when waste is involved, and that it may under that power enact laws to promote the conservation of these natural resources and for the prevention of their waste. The waste involved in these cases and pro-

to convert a part of the common fund to actual possession may result in an undue proportion being attributed to one of the possessors of the right, to the detriment of the others, or by waste by one or more, to the annihilation of the rights of the remainder. Hence it is that the legislative power, from the peculiar nature of the right and the objects upon which it is to be exerted, can be manifested for the purpose of protecting all the collective owners, by securing a just distribution, to arise from the enjoyment by them, of their privilege to reduce to possession, and to reach the like end by preventing waste."

¹⁶ *Lindsley v. Natural Carbonic Gas Co.*, 220 U. S. 61 (1911).

¹⁷ *Walls v. Midland Carbon Co.*, 254 U. S. 300 (1920).

hibited by the state statutes was physical waste as distinguished from economic waste.

State conservation statutes with respect to oil and gas have so far generally dealt only with physical waste.¹⁸ Due to continuous overproduction of oil in recent years and the consequent like decline in prices, there have been insistent demands from the oil industry for measures to control and curtail production in excess of legitimate market demands. As already noted, periods of overproduction have occurred in the past with the discovery of every new major oil pool. With oil already producing and in storage far in excess of market demands came the discovery of the great East Texas field at the close of 1929. By the summer of 1931 overproduction of oil had reached such an extent that oil in this field was selling for ten cents a barrel and royalty owners were offered five cents.¹⁹

In this desperate situation the Governor of Oklahoma declared martial law in the oil fields and ordered the militia to shut in the oil wells until buyers would agree to pay producers one dollar per barrel for the oil. The flush Oklahoma City field was the one most directly affected by this order. The Governor of Texas followed with a like declaration of martial law with respect to the East Texas field, where wells were put on part production. It has never been seriously considered that these enforced shutdowns of production under orders based upon martial law had any legal validity.²⁰ In a recent decision by a

¹⁸Tex. General and Special Laws—First Called Session 1931, ch. 26; Laws of Kan. 1931, ch. 226; Calif. Statutes and Amendments to the Codes 1929, ch. 535; ch. 535, Statutes and Amendments to the Codes of Calif., 1931, sec. 2, is broad enough in its definition of waste to include economic waste. But this statute was defeated at referendum election on May 3, 1932, by more than 3 to 1—N. Y. Times May 5, 1932, 2:6. "It was opposed by a group of independents on the ground that it would create a monopoly"; Marr's Anno. Rev. Stats. of La. Supp. 1926, pp. 822, 826; Acts of Ark. 1923, Act 664, sec. 4, prohibits production of gas in excess of market demands, which is broad enough to cover economic waste; Session Laws of Oklahoma 1915, ch. 25, sec. 3, expressly includes economic waste; and Tex., cited in this note, expressly excludes economic waste. In *Danciger Oil and Refining Co. v. Railroad Commission* (Tex. Civ. App.) 49 S. W. (2d) 837 at 843 the court defines "economic waste" as "economic loss in the production, sale, use, or disposition by the owners or operators of oil properly produced by them without physical waste of the resource itself."

¹⁹One sale of 40,000 barrels of oil is reported to have been made for \$1,000.

²⁰Logan, *The Use of Martial Law to Regulate the Economic Welfare of the State and Its Citizens*, 17 Ia. L. Rev. 40; Bruce, *The Oil*

three-judge federal district court it was held that the martial law proclaimed by the Governor of Texas was without warrant of law and an illegal usurpation of power belonging to the civil authorities.²¹ The Governor appealed the case to the United States Supreme Court,²² which affirmed the court below. There would seem to be even less warrant for sustaining the action of the Governor of Oklahoma.²³

PRORATION

The most common means that is now employed in attempting to stabilize the oil industry by securing a settled production responsive to market demand is proration. "Proration has no connection with producing methods but is the term applied to the effort to allocate the amount of oil which may be taken from any given producing area."²⁴ It is not a true conservation measure in the sense that it is designed to prevent physical waste but is intended as a device to control the amount of production and bring the oil on the market no faster than there is a legitimate demand for it and the products therefrom. It is a temporary conservation measure at most. Proration will, however, promote conservation by reducing the amount of oil held in storage where it is subject to physical waste. It is also well known that when wells are produced at full flush capacity large underground waste takes place by excessive waste of gas and failure to secure a uniform water-drive. Gas expands too rapidly to utilize its full force in driving the oil out of the sands and the undue reduction of pressure caused by such wells may cause the water edge to "cone" and "channel" with the pos-

Situation and the Military, 17 Am. Bar Asso. Jour. 643; Marshall and Meyers, Legal Planning of Petroleum Production, 41 Yale L. Jour. 33, 52; *Russel Petroleum Co. v. Walker* (Okla.), 19 P. (2d) 582, held the state militia could be enjoined from acting under unlawful executive orders.

²¹ *Constantin v. Smith*, 57 F. (2d) 227 (1932).

²² *Sterling v. Constantin*, 52 S. Ct. 503, 53 S. Ct. 190.

²³ In the recent case of *Russell Petroleum Co. v. Walker* (Okla.), 19 P. (2d) 582, the court held that the executive orders of the Governor in calling out the state militia to take possession of the oil wells and enforce laws relating to prevention of waste deprived the operator of oil wells of property without due process of law and that the District Court could enjoin the militia acting under the unlawful executive orders.

²⁴ Secretary Wilbur, Address before Governors' Conference at Washington, D. C., January 16, 1931.

sible result of large bodies of oil being cut off from the well and lost to recovery. It has been looked upon as a price fixing device by keeping oil off the market and thus avoid reduction of price by creating a supply greater than the demand.²⁵

The Oklahoma statute provides for proration of oil production. It prohibits the taking of crude oil when there is not a market demand at the well at a price equivalent to the actual value of such crude oil. It also provides that whenever the full production from any common source of supply of oil can only be obtained under conditions constituting waste, then any one having the right to produce oil from such common source of supply, may take therefrom only such proportion of all crude oil that may be produced without waste, as the proportion of the well or wells of such party bears to the total production of such common source of supply. The Corporation Commission is authorized to so regulate the taking of crude oil from any or all such common sources of supply as to prevent the inequitable or unfair taking, from a common source of supply, of such crude oil by any party and to prevent unreasonable discrimination in favor of any one such common source of supply as against another.²⁶

²⁵ Merrill, Oil Stabilization and Due Process, 3 So. Cal. L. Rev. 396, 401: "The prime purpose sought by proration is 'stabilization'—the maintenance of price levels at a satisfactory point by curbing the market-breaking orgies of production"; Marshall and Meyers, Legal Planning of Petroleum Production, 41 Yale L. Jour. 33, 65; 45 Harv. L. Rev. 557; 31 Col. L. Rev. 1170; 19 Cal. L. Rev. 416; 20 Cal. L. Rev. 203; 17 Va. L. Rev. 173; 16 St. Louis L. Rev. 227, 240, 221, 234. But in *Champlin Refining Co. v. Corporation Commission*, 52 S. Ct. 559, the court denied that proration has had the effect of regulating prices. At page 564 it says: "The court found that none of the proration orders here involved were made for the purpose of fixing prices. The fact that the commission never limited production below market demand and the great and long continued downward trend of prices contemporaneously with the enforcement of proration strongly support the finding that the orders assailed have not had that effect." A like contention that the real purpose of the California statute was to curtail the production of oil so as to regulate and stabilize the market price thereof was denied by the court of that state. *People v. Associated Oil Co.* (Calif.), 294 P. 717, 725. For a discussion of proration statutes, see Ford, Controlling the Production of Oil, 30 Mich. L. R. 1170, 1190-1201; Pogue, Economics of Proration Petroleum Development and Technology 1932, p. 69; 21 Cal. L. R. 38; Marshall, Proration, Conservation and Crude Prices, Oil and Gas Jour., 31, 20, p. 10 (10/6/32); Marshall and Meyers, Legal Planning of Petroleum Production; Two Years of Proration, 42 Yale L. J. 702. See Article on Petroleum in last issue of Vol. 6 of So. Calif. L. Rev. (May, 1933).

²⁶ Session Laws of Oklahoma 1915, ch. 25, secs. 2, 4.

Under the authority of this statute the Corporation Commission made various proration orders classifying the several producing fields in the state, and provided that each producer in such classified field might take from such pool or area only such proportion of all crude oil that might be produced therefrom, under such order, as the production of the well or wells of such owner in such pool bore to the total potential production of such pool or area. The orders further provided for an umpire, operators' committees, agents, etc., to carry out the provisions of such orders and regulations. The Julian Oil Company, who were the owners of one-fourth acre in the Oklahoma City field, insisted on producing their well to full capacity on this area and sought a writ of prohibition against the Commission to prohibit the enforcement of the order against them to prevent waste by limiting their production. The court upheld the proration statute and the orders and regulations made thereunder by the commission.²⁷ The statute and order were sustained as a valid exercise of the police power by the state. Under the common-law maxim that "every one must so use his own property as not to injure the rights of others" the state has the right to regulate the taking of property from a common source of supply and to protect the correlative rights of adjoining landowners therein. As to the price-fixing argument, Hunt, in a concurring opinion, stated that the influence on price was merely incidental, and that the primary purpose of the statute and orders is to conserve oil and gas and prevent unreasonable waste.

The statute and the same orders of the Corporation Commission were brought in question in the federal court in a suit to enjoin their enforcement. The penal provisions of the statute were held to be too indefinite and uncertain to be sustained, but as they were separable they did not affect the validity of the rest of the statute, which the court upheld, including the orders

²⁷ *C. C. Julian Oil & Royalties Co. v. Capshaw* (Okla.), 292 P. 841; 5 So. Cal. L. R. 66. Later cases sustaining the Oklahoma conservation law are: *Russell v. Walker* (Okla.), 15 P. (2d) 114; *Russell Petroleum Co. v. Walker* (Okla.), 15 P. (2d) 125. In *H. F. Wilcox Oil & Gas Co. v. State* (Okla.), 19 P. (2d) 347, this statute authorizing the corporation commission to invoke rules preventing waste was held to apply only to production and not to sale or transportation of crude oil and its products.

of the Commission for proration which were complained of.²⁸ The court stated that the power of the state to impose reasonable regulations to prevent waste in the production, handling and marketing of oil and gas, which are irreplaceable natural resources, is undoubted. To permit oil wells to flow at their maximum flush production results in the use of an excessive amount of gas pressure, an uneconomical and wasteful use of gas energy in lifting the oil, and a tremendous loss of ultimate recovery. Wells should be permitted to produce with the lowest practicable gas-oil ratio to the end that the gas pressure shall be preserved throughout a long period and the greatest ultimate recovery of gas and oil obtained. The theory of the orders of the Commission is that oil from a given pool shall not be produced in excess of the market demands therefor in order to prevent wasteful storage and wasteful use of gas pressure in lifting the oil. Therefore, the limiting of the taking of oil to the market demands is a reasonable regulation for the prevention of waste and the protection of the co-equal rights of the owners of land over the common pool. This case was unanimously affirmed by the Supreme Court of the United States.²⁹

The plaintiff insisted that it had a vested right to drill wells upon its leases and to take all the natural flow of oil and gas therefrom so long as it did so without physical waste and devoted the production to commercial uses. To this the court at page 564 said: "But if plaintiff should take all the flow of its wells, there would inevitably result great physical waste even if its entire production should be devoted to useful purposes. The improvident use of natural gas pressure inevitably attending such operations would cause great diminution in the quantity of crude oil ultimately to be recovered from the pool. Other lessees and owners of land above the pool would be compelled, for self-protection against plaintiff's taking, also to draw from the common source, and so to add to the wasteful use of lifting pressure." The court further says that "the power of the state to prevent unnecessary loss, destruction or waste, extends to the taker's unreasonable and wasteful use of natural gas pressure available for lifting the oil to the surface, and the un-

²⁸ *Champlin Refining Co. v. Corporation Commission of Okla.*, 51 F. (2d) 823.

²⁹ Same case, 52 S. Ct. 559.

reasonable and wasteful depletion of a common supply of gas and oil to the injury of others entitled to resort to and take from the same pool." The order of the commission which allotted to plaintiff that proportion of all crude oil, which may be produced from a common source without waste, that the production of plaintiff's wells bore to the total production from such source was accordingly upheld as reasonable. Here as in prior cases the court emphasizes the correlative rights of the various surface owners to the oil and gas in a common source of supply.

The California conservation statute of 1929 creates a department of natural resources to be in charge of a state oil and gas supervisor. Among his duties are the supervision of drilling, operation, maintenance and abandonment of wells; the prevention of damage to underground oil and gas deposits from infiltration of water and loss of oil and gas. Unreasonable waste of natural gas is declared to be opposed to the public interest and is prohibited. The blowing, release or escape of natural gas into the air is declared to be prima facie evidence of unreasonable waste. The statute legalizes agreements between lessees and lessors, when approved by the supervisor, for the purpose of bringing about co-operative development and operation of oil fields, in whole or in part, as a unit and for representing fields, etc. The supervisor can, upon hearing, order the discontinuance of unreasonable waste and may have it enjoined. The chief feature of this statute is the gas-oil ratio provision. While it authorizes unit operation, it does not provide for proration of production.³⁰ The California statute of 1931, which as previously noted was defeated at referendum, provided for proration.

In a suit to restrain the unreasonable waste of natural gas the court defined such waste to occur when "gas which has been allowed to come to the surface without its lifting power having been utilized to produce the greatest quantity of oil in proportion."³¹ The gas-oil ratio is the proportion which the total number of cubic feet of formation gas bears to the total number of barrels of net oil produced from the same well at

³⁰ Statutes and Amendments to the Codes of Calif. 1929, ch. 535.

³¹ *People v. Associated Oil Co.* (Cal.), 294 P. 717, 724.

the same time.³² If too much gas is produced per barrel of oil the gas-oil ratio will be too high, and the amount of gas produced should either be reduced or the well entirely shut in to avoid wasting of reservoir energy. When this case was before the court again it was held that this statute had lawfully vested in the superior court the power to determine what wastage of gas in the production of oil is reasonable or unreasonable; and that this is a question of fact in each case.³³

This statute was further challenged in the Bandini case. That involved an application for a writ of prohibition against enjoining the oil company from unreasonably wasting natural gas from their wells in the Santa Fe Springs oil field. The writ was denied and the statute sustained.³⁴ It was stated that under the California law the surface owner has absolute title to oil and gas only when they are reduced to possession, and that a statute prohibiting unreasonable waste of natural gas when in excess of reasonable proportion to oil produced when not conveniently necessary for other than lifting purposes is valid. This case was affirmed by the United States Supreme Court without dissent.³⁵ The court quotes with approval the state court, that there is an "unreasonable waste" of gas where it "has been allowed to come to the surface without its lifting power having been utilized to produce the greatest quantity of oil in proportion." The standard set by the statute—that "gas may not be produced, under existing conditions where the production thereof so greatly exceeds the market demand therefor, in quantities exceeding a reasonable proportion to the amount of oil produced"—is sufficiently definite. The court further says: "If the statute be viewed as one regulating the exercise of the correlative rights of surface owners with respect to a common source of supply of oil and gas, the conclusion that the statute is valid upon its face—is fully supported by the decisions of this court."³⁶

The Texas oil and gas conservation statute enacted at the special session in 1931 does not require unitization of oil pools,

³² *Ibid.*, 719

³³ Same case, 297 P. 536.

³⁴ *Bandini Petroleum Co. v. Superior Court of Los Angeles County* (Cal.) 293 P. 899.

³⁵ Same case, 52 S. Ct. 103.

³⁶ *Ibid.*, 106, 107, 108.

but any well producing gas only shall within ten days be confined until the gas shall be utilized for light or fuel or used for repressuring purposes. The statute confers power upon the Railroad Commission to reduce production of oil or gas from any well or pool to prevent physical waste, and the Commission is given power to prorate or apportion such reduction among the wells committing waste.³⁷

The validity of this recent statute has been brought in question in a case where the plaintiff, prior to the enactment of the statute, had constructed at a cost of several hundred thousand dollars a modern gas extracting plant, which he has operated continuously since. It also appeared that there was no market for the gas and that after the gasoline had been extracted therefrom it was allowed to blow into the air in violation of the statute since enacted. Plaintiff sought an injunction restraining the Railroad Commission from enforcing the statute which would require that the plaintiff cease to operate his plant. The injunction was denied and the statute sustained.³⁸ The Walls case which is cited by the court is almost parallel to this case.

In the MacMillan case a proration order of the Texas Railroad Commission entered under an earlier statute³⁹ was involved. The order was based upon acreage unit of 20- and 40-acre lots, and not per well, in effect allowing the same production from each unit irrespective of the number of wells upon it. The court held the proration order invalid on the theory that it was a price-fixing order.⁴⁰ The argument of the court is not very convincing.

³⁷ Texas General and Special Laws—First Called Session 1931, ch. 26, sec. 7, provides for proration. On the new oil conservation bill introduced in the Texas Legislature, see Oil and Gas Jour. 31, 25, p. 8 (11/10/32); Beaty, Texas Law discussed, Oil and Gas Jour. 31, 26, p. 24 (11/17/32).

³⁸ *F. C. Henderson, Inc. v. Railroad Commission of Texas*, 56 F. (2d) 218. The statute has also been sustained in later cases—*People's Petroleum Producers v. Sterling*, 60 F. (2d) 1041; *People's Petroleum Producers v. Smith*, 1 F. Supp. 361. On the last case the administration of the statute by the Railroad Commission was held invalid. The order of the commission limited production in the East Texas field and apportioned the allowed production equally per well without regard to the potential capacity of the wells. The order was held void.

³⁹ Tex. Gen. Stats. 1925, Art. 6023, 6029, and Art. 6014 as amended in Tex. Gen. and Spec. Laws 1929, ch. 313, sec. 2.

⁴⁰ *MacMillan v. Railroad Commission of Texas*, 51 F. (2d) 400. On appeal the decree was reversed and cause remanded with directions

The same statute and proration orders made thereunder were contested in the state courts of Texas. The plaintiff corporation operated several oil wells in the Panhandle district and complained that their production of oil was prorated to 25 per cent. of its potential production. The orders were general and covered the whole state. This statute conferred no express authority to curtail or prorate production, but the commission was empowered to enforce the same, and the production of natural gas or crude petroleum under conditions so as to constitute waste was prohibited by it. The plaintiff's application to enjoin the enforcement of the statute and orders is denied. The court adverts to the fact that waste has been prevented in Kansas, California and Oklahoma by proration and criticizes and declines to follow the MacMillan Case. With respect to that case it says: "While we have great deference and regard for the opinion of the court that decided the MacMillan Case, in the light of the evidence in this record, and of the fact that the Legislatures of the four leading oil-producing states of the nation have recognized and authorized proration as a reasonable and effective means of preventing underground waste, we are constrained to differ with the conclusion of that honorable court that results of such method are largely 'theory and speculation'. And since the court in that case did not base its decision on any federal question, but on the ground that the powers claimed by the commission under the state law had not been delegated to it by that law, we must differ with that estimable court and respectfully decline to follow its construction of our statute."⁴¹

The case is in accord with the Julian, Bandini, and Associated Oil Company cases from Oklahoma and California. It thus appears that proration has been sustained by the state courts in the three leading oil states and by the federal courts from Oklahoma and Texas and by the United States Supreme Court in cases arising from California and Oklahoma.

The Texas statute of 1919, chapter 155, empowered the Commission to make rules and regulations for the drilling of

to dismiss the bill of complaint. *Railroad Commission v. McMillan*, 53 S. Ct. 223.

⁴¹ *Danciger Oil & Refining Co. v. Railroad Commission* (Tex. Civ. App.), 49 S. W. (2d) 837, 843.

wells in such a manner as to prevent injury to the adjoining property. Under this authority the Commission promulgated a rule that no well for oil or gas shall be drilled nearer than 300 feet to any other completed or drilling well on the same or adjoining tract, nor nearer than 150 feet to any property line, but that the Commission may grant permission to drill within shorter distances. Plaintiff owned a strip of land 3,190 feet long and 36 feet wide at one end and 56 feet wide at the other. The plaintiff was denied the right to drill ten wells as planned, but allowed to drill four. The court upheld the regulation of the Commission.⁴² The case was affirmed by the Circuit Court of Appeals⁴³ and certiorari denied by the United States Supreme Court. As the Railroad Commission was not created by the constitution, it was held to be competent for the legislature to impose powers and duties upon it in addition to the powers granted to regulate railroads and railroad rates.

A rule of the commission under the same statute prohibiting the use of vacuum pumps to increase the flow of oil was sustained. The court said that "the right of one leaseholder to acquire more than his pro rata portion of the common reservoir is limited to the production of oil from a natural flow or from pumping by ordinary methods, to the exclusion of the artificial method of vacuum pumps forbidden by the rule of the commission."⁴⁴

Not only is the Commission here given the power to make rules having the force of statute, but it may regulate the spacing and location of wells contrary to the law formerly prevailing that a landowner could drill as many wells on his land as he

⁴² *Oxford Oil Co. v. Atlantic Oil and Producing Co.*, 16 F. (2d) 639; The statement by Judge Veasey that "this holding is not sound" cannot be admitted unless we are willing to concede that the law is stationary and incapable of growth by adjusting itself to new conditions as new facts are discovered. Nor can we agree that the landowner has a vested property right to locate his wells anywhere on his land, "even though his wells are so located as to drain much or the greater part of their production from adjacent lands" and thus secure a disproportionate share of the oil from a common source of supply. This right has been denied by the United States Supreme Court in *Ohio Oil Co. v. Indiana*, and in every subsequent case where the question has been considered. The states may by statute change that property rule. Veasey, note 3, *supra*, at 616.

⁴³ Same case, 22 F. (2d) 597; 277 U. S. 585.

⁴⁴ *Peterson v. Grayce Oil Co.* (Tex. Civ. App.), 37 S. W. (2d) 367, 372.

chose and at any place he desired. The Oxford case is not only authority for the proposition that it is competent for the legislature to modify the old property law of capture with respect to oil and gas but that it may also delegate such authority to a subordinate body. Indeed, it is the very function of legislation to modify the pre-existing common law.

That the law will adjust itself to new and changing conditions is forcibly presented in a recent case from Kentucky where it was sought to enforce an implied covenant to drill offset wells. The lessee's defense was that "the lease had already been drilled and developed as much as conditions of the market and cost of drilling and operation justified, and that under existing and prevailing conditions in the oil business it will be imprudent and with sacrifice and loss to the parties concerned to develop further at the present time." The court took notice that "there is a nation-wide depression existing and prevailing" and sustained the defense.⁴⁵ Nowhere have the courts before been more uncompromising than in their strict enforcement of forfeitures for failure to comply with implied covenants to drill off-set wells to protect the lessor from drainage.

The cases in the United States Supreme Court beginning with *Ohio Oil Company v. Indiana* and culminating in the recent *Bandini* and *Champlin* cases and the state and federal cases hereinbefore considered must be taken as conclusively settling that not only may the state prevent physical waste of oil and gas but that it may prorate the production according to market demands and thereby stabilize production, although this may incidentally affect prices of oil products. The state may delegate to a commission the power to make rules and regulations for the spacing of wells and their number and regulate the use of gas so as to prevent wasting reservoir energy which is so essential for production of oil and prevent underground waste by failure to recover the oil because of the loss of such energy.

But proration is only a temporary expedient to regulate production and prevent oil being put on the market in excess of all legitimate demands. It is designed to avoid the costly

⁴⁵ *Leeper Oil Co. v. Rowland* (Ky.), 39 S. W. (2d) 486; 41 Y. L. J. 286. For the same tendency of courts to adapt the law to existing knowledge and conditions, see the Arkansas court in *Bodcaw Lumber Co. v. Goode*, note 37, *infra*.

storage of oil and loss by evaporation incident thereto. If the system is enforced by a sufficient number of the oil states it will prevent abnormal breaks in the market and stabilize prices by insuring a settled production. "The outstanding deficiency in this proration program is that it is not yet national in scope.⁴⁶ But the proration system does not provide the necessary machinery for the development of an oil pool upon what is now known to be correct scientific principles. It does not solve the problems of correct spacing and number of wells, nor the economic waste incident to overdrilling and needless wells that serve only the purpose of set-off, nor is proration adapted for the proper regulation and conservation of reservoir energy and for repressuring of oil fields. Such problems and many others can only be solved by the further conservation measure designated as co-operative or unit development of oil pools.

It has been suggested that proration should not be based upon the number of wells alone, but the acreage and oil content should form the basis of proration. If the acreage content cannot be determined it should be assumed to be homogeneous for the pool and proration based upon acreage. Thus if X is the proper amount of acreage for one well, and A has only X/10 acres and drills one well, he should be allowed to produce only one-tenth of the well's potential production. Likewise, if B has X acres for just one well but desires to drill four, then he should be permitted to produce only one-fourth of the potential production from each of the four wells.⁴⁷

UNIT OPERATION

Co-operative or unit operation and development of oil pools afford the only permanent solution for the prevention of physical and economic waste incident to the production of petroleum and the only adequate basis for regulation co-ordinating supply with demand to secure a stabilization of the prize structure. Unit operation of a single pool can only serve to prevent waste. There will be no effect on the general stabilization of oil production unless unit operation is sufficiently wide-

⁴⁶ George Otis Smith, American Petroleum Institute Proceedings, Production Bulletin No. 206, p. 75.

⁴⁷ Oliver and German, 30, 10 Oil and Gas Jour., p. 15 (July 23, 1931).

spread within a country, and co-operation to adjust production to market demands must even assume the form of a world movement. One country alone cannot stabilize production if others continue to produce in disregard of demand.

To secure the advantages of unit operation it is obviously desirable that the oil pool be controlled by a single concern. Foreign oil fields often operated on concessions made to a single oil company have these advantages. Hence it is there that we find the best operated pools and the best application of conservation principles to be found anywhere. If more than one large company operate in a single field they are usually able to co-operate and thus secure the advantages of unit operation.

The obstacles confronting the adoption of unit operation are found in pools where the surface is vested in many independent owners. There the difficulty is to secure any voluntary agreement among the various surface owners and lessees for co-operative development. If development of the pool is to proceed along lines of conservation it is clear that each surface owner cannot be permitted to drill where he pleases and as many wells as he chooses. Some may drill into the gas zone only. Such wells should be shut in or the reservoir energy will be wasted for the others. Then others with small areas are likely to get much more than their share of oil by drainage from their neighbor's lands.

An estate at common law extends vertically upwards and downward. Each landowner over the pool is equitably entitled to all the oil beneath his surface confined within those vertical planes as it exists in the pool in its original state and before any drainage has taken place. If that oil content can be determined prior to any production from the pool, then all the surface owners over the pool can be treated as tenants in common of the contents of the pool in the proportion that the oil underneath his surface bears to the total contents of the pool. It will then be immaterial through which well the oil comes or on whose land the well is located. Each tenant in common of the pool will receive his proportional fraction of the oil that comes from the pool irrespective of where the wells are located. If that can be determined the pool can be developed as a unit along lines required to insure conservation and with justice to

all the owners in the pool. That, however, presents an engineering problem which has not yet been fully solved.⁴⁸ Claims have been made that this can be determined within three per cent.⁴⁹ However, an approximate determination of the acreage content with adjustments as new knowledge is acquired by drilling would afford greater justice to all than the present system of competitive drilling where those with facilities for handling production generally get far more than their share. Then the amount of oil that the pool would produce by conserving the gas pressure would be much greater than under competitive drilling where it is wasted.

Unit operation of a pool where there are a great many

⁴⁸ W. P. Z. German states the problem thus: "The new conception of oil production is that each producer in a pool is entitled to an opportunity to receive directly or indirectly and to enjoy a fair and equitable share of the recoverable oil and gas from the pool in which his land is located and that he is entitled to have the pool so efficiently operated as to result in a maximum recovery at a minimum cost." *Legal Aspects of Equitable Extraction and Distribution of Recoverable Oil*, Production Bulletin No. 208, p. 15; 30, 26 Oil and Gas Jour., p. 34 (Nov. 12, 1931).

As to the tendency of courts to recognize the rights of the landowner to the oil beneath his surface the Arkansas court has said: "According to many writers on this subject, the view most generally entertained by geologists at present is that gas and oil are not of a vagrant character and do not migrate but maintain their situs until they are drawn out or expel themselves by pressure through artificial openings in the surface, and the tendency of later decisions is to hold that oil and gas while in place and before being drawn out by artificial openings are as much a part of the realty as fixed minerals, such as coal or iron." *Bodcaw Lumber Co. v. Goode* (Ark.), 254 S. W. 345, 348.

"It is the function of the engineer to outline the conditions under which oil fields should be developed and of the lawyer to determine the method by which that can be legally accomplished." Nyce, *Cooperation Between Engineers and Lawyers*, 17 Am. Bar Asso. Jour. 325, 327; *Petroleum Development and Technology* 1931, pp. 38, 43.

Earl Oliver, *Methods of Determining Relative Oil and Gas Content of Individual Land Holdings in Common Pool*, 17 Am. Bar. Asso. Jour. 541, gives expressions from various engineers and concludes that "engineers are of the opinion that methods can be devised whereby the relative content of adjacent tracts in the common pool can be determined with justice to all parties."

⁴⁹ See J. E. Pew, *The New Conception of Oil Production*, Production Bulletin No. 208, pp. 7, 9, Am. Petroleum Institute. "Engineers claim to be able to estimate within 3 per cent the amount of oil recoverable from a given proved area." Compare statement of H. C. Fowler, Acting Chief Engineer, Petroleum and Natural Gas Division, Bureau of Mines—"No definite method has been worked out by petroleum engineers to equitably distribute proceeds of an oil pool under unit operation."—Letter to writer, March 23, 1932. See also Holliday, *Oil's Legal and Economic Handicaps*, Oil and Gas Jour. 29, 45, p. 34 (3/26/31).

surface owners would be impossible to achieve were voluntary agreements alone to be relied on. In most cases it would be impossible to secure unanimity, as some one would refuse to join the pool, and a single driller on his own account would start a competitive race. Legislation would be necessary to compel joinder in unit operation when the majority or some greater proportion of the surface owners desired to so operate the pool. Unit operation does not require a merger of land titles, and such merger could probably not be compelled under our constitution. But if the petroleum engineers and geologists can determine the surface owner's share of the oil in the pool, that is, the acreage content, the oil in the pool beneath each owner's surface, to the satisfaction of courts and legislators, there would seem to be no reason why the law cannot make the surface owners tenants in common of the oil in the pool, and thus recognize such correlative rights of the owners. There would seem to be no constitutional objection to that. The difficulty is with the engineering problem which has not yet been solved. When that is accomplished the legal problem will afford no difficulty. Much complaint has been directed against the present state of the law when in fact the real difficulty is the unsolved engineering problem of determining the acreage content of the oil pool.

Then since development of a unitized pool would of necessity have to be delayed pending tests to determine the acreage content and in view of the further fact that development thereafter may proceed too slowly to suit the financial necessities of some surface owners any agreement for unitized development should provide means by which such owners could assign their interest in the oil for cash in advance of development. Such assigned interests should be subject to subsequent correction as further knowledge of the oil content of the pool is acquired by development. And to prevent opportunities for fraud such assignments should be under the supervision of the state agency.

The committee on conservation of mineral resources of the section of mineral law of the American Bar Association in 1929 drafted a bill proposing compulsory unit operation of oil pools to be enforced by state legislation.⁵⁰ This plan has not been

⁵⁰ 54 Reports of Am. Bar. Asso. 741, 762; Report III of the Federal Oil Conservation Board, 26, 43. Section 3 of the bill provides that

adopted by any state so far. The bill is fatally defective in that it attempts to enforce compulsory unit operation upon a minority of the landowners or lessees in the pool without any provision for determining the acreage content in the pool so that the several owners may become tenants in common in the pool. Without such previous determination there is no way to ascertain what part of the oil belongs to each owner, and the measure at most becomes one to enforce the prorating of production. It is a bill for compulsory proration rather than for unit operation.

W. P. Z. German, in an article on compulsory unit operation of oil pools, also fails to go to the root of the matter which requires, as we have shown, a determination of the acreage content of the various holdings of the surface owners and then making them tenants in common of the contents of the pool.⁵¹

"should a majority of the operators in a new oil and gas pool agree in writing upon a co-operative plan for the development and operation of said pool . . . they may . . . file with said commission a petition . . . for the compulsory co-operative development and operation of each separate holding in said pool, in accordance with said plan." The rest of the bill provides for the execution of such plan.

⁵¹ German states that the term "unit operation" has two meanings; "one being the merging of titles and the development and operation of the one unitized area as if it were one tract of land held under a single oil and gas lease according to a definite program intended to accomplish a maximum recovery from the pool as a whole at a minimum of cost. It is incomplete when the royalty owners do not also merge their titles to their oil and gas rights in the area and is complete when they do. The other is not accompanied by any merger of titles but the development and operation of the area are in accordance, as nearly as reasonably practicable, with such a program . . . If there cannot be unit operation without a merger of titles, then it would seem that the state cannot require unit operation for it cannot require a merging of titles; but if it may consist in requiring each, and all of the leaseholders to develop and operate or to submit to a development and operation according to some such common plan . . . without at the same time requiring a merger of titles, then it would seem that unit operation may be required by the state." *Compulsory Unit Operation of Oil Pools, Petroleum Development and Technology* 1931, p. 11; 17 *Am. Bar Asso. Jour.* 393; 20 *Cal. L. Rev.* 111; see also Veasey, *The Struggle of the American Petroleum Industry for Economic Equality*, N. Mex. Bar. Asso. Report 1931, 98, 120-124. Report IV of the Federal Oil Conservation Board, pp. 17-24, *Progress in Unit Operation*. At p. 24 the Report concludes: "Self-regulation by voluntary co-operative action in the handling of an oil pool means both efficiency in development and operation and the determination of equities among the owners, and this can best be accomplished by unit operation. By this plan only can each and every owner secure full economic benefits. By this plan only can the public be assured of the largest possible supply of oil and gas from a particular field, won from the ground at lowest cost, and over a period measured by market de-

His proposal to develop a pool as one unitized area according to a "definite program" intended to secure a maximum recovery from the whole pool at a minimum of cost will not function in absence of a prior determination of the oil content belonging to each surface owner. In absence of such prior determination there is no way to allocate to each owner his share of oil as it comes from the pool under unit operation. Some have proposed that the oil be allocated to the surface owners in proportion to surface area. Obviously that would be unjust unless the limits of the pool were accurately known and the pool was homogeneous in oil content. But such conditions are never found in a pool. In the absence of a prior determination of the acreage content in a pool—and before that is done a pool cannot be developed as a unit where there are many surface owners with any justice to the several owners—each surface owner must be permitted to drill on his own land, and the most that the state can in justice require is that the several surface owners prorate their production according to market demands to be ascertained and determined by some state agency.

It is generally conceded that agreements among operators for controlling production that would be state wide or nation wide in extent would violate present anti-trust laws, both state and federal. Such agreements with respect to a single pool or oil field could have no such effect. If anti-trust laws are modified so as to permit such agreements of state wide and national scope it would be essential for the protection of the consumer and the public that all such agreements looking to the curtailment of production in times of overproduction should be subject to the approval of state and national agencies, and that such agencies be vested with authority to determine when a period of overproduction exists and when it has terminated. And agreements for curtailing production should only be lawful and approved during such periods when production exceeds legitimate market demands. Such powers of control could be given to the various state agencies now vested with powers to supervise oil and gas production. In the case of the National Gov-

mand rather than fixed by individualistic greed. Justice to all owners and benefit to the public can both result from this observance of natural and economic law in recognizing the oil pool as the natural unit."

ernment, Congress could confer the power upon the Federal Oil Conservation Board. New Mexico has provided that agreements made in the interest of conservation of oil and gas and for unit operation, when approved by the State Geologist, shall be permitted and shall not be construed to violate the state anti-trust laws.⁵²

Certain legal principles which it is believed should be incorporated into the law of oil and gas have been worked out by lawyers and engineers, co-operating.⁵³ The first principle

⁵² Laws of New Mexico 1929, ch. 132. See also Myers, Relations of the Federal Anti-trust Laws to Problems of Mineral Conservation, 55 Reports Am. Bar Asso. 672; Butler, Proposed Anti-Trust Law Amendments, 56 Reports Am. Bar Asso. 682, 80 U. of Pa. L. Rev. 730; Sutro, Sherman Law an Economic Impediment, Oil and Gas Jour. 30, 25, p. 16. Proposed amendment to Sherman Law—"Nothing in this act contained shall be deemed to render illegal any contract, combination, trade agreement or trade practice approved by the Federal Trade Commission after finding by the commission that the same is not an unreasonable restraint of competition or of trade, and every such contract, combination, trade agreement or trade practice shall be deemed to be valid while such approval remains in force and unrevoked."

⁵³ These are: 1. That each landowner or his assigns shall be declared entitled to those proportions of the oil and gas in the common reservoir that underlie his land, and shall be protected in their enjoyment. 2. That the forces of expulsion native to the reservoir shall be declared common attributes of the reservoir to be conserved to the common interest of its several owners, and shall not be dissipated except as they are efficiently utilized in driving oil and gas from the reservoir rock to the point of extraction. When these forces have been so utilized then both the gas and oil should be delivered to their respective owners. 3. That the state in its function of preventing waste of natural resources may require and prescribe efficient methods of exploiting oil and gas fields. 4. That during the periods of general overproduction the state, in order to prevent waste and/or to protect the producers, as per item 1 above, may determine from time to time the maximum amount of oil and gas that may be produced within the state, and to that end shall have authority to limit the production in any pool not to exceed the market demand for oil therein: 5. That authority should be delegated to a state agency to formulate rules and regulations from time to time for the application and enforcement of the above principles. 56 Reports Am. Bar Asso. 699 (1931).

The above five principles have been discussed in a series of articles by Oliver and German in the Oil and Gas Journal, Vol. 30, 10, p. 15, 7/23/31; State Has Right to Protect Ownership, 30, 11, p. 23; Conservation of Energy in Reservoir, 30, 12, p. 17; State Should Require Efficient Methods of Exploiting Oil and Gas Pools, 30, 13, p. 16; State Should Equalize Oil Production, 30, 14, p. 19; Methods of Applying Unit Operation, 30, 15, p. 14.

See also Suman, Pool Development Has Been One-Sided, Oil and Gas Jour. 30, 26, p. 32 (11/12/31); Pew, Time is Ripe for Unitized Production, *id.* 38; German, Legal Aspects of Unitized Operations, *id.* 34; Oliver, Reservoir Energy is Crucial Point, Oil and Gas Jour., 30, 27, p. 16; Oliver, Present Methods Encourage Big Waste, Oil and Gas Jour. 30, 31, p. 21; Oliver, Leaders in Agreement on Fundamentals, Oil

clearly involves a determination of the acreage content before it can be administered. If this can be determined within reasonable bounds, not with mathematical accuracy, it should be sufficient. This determination, necessarily somewhat superficial at first, can be corrected and adjusted as development of the pool proceeds and new knowledge is acquired. Substantial justice to all is all that the law should require. Having achieved this, the law can declare the correlative rights of the various owners in the pool and make them tenants in common on the basis of such proportional determination of the contents in the pool. No constitutional objection to enforced unit operation on that basis can be perceived. All owners will then be required to share in the expense of development and in the proceeds from the pool in proportion to their fractional interest in the pool as tenants

and Gas Jour. 30, 24, p. 14; Umpleby, Changing Concepts in the Oil Industry, Oil and Gas Jour. 30, 47, p. 18; Oliver, Oil Industry's Problems and Remedies, Oil and Gas Jour. 30, 49, p. 14; Oliver, Co-operation Between Lawyers and Engineers, 56 Reports Am. Bar Asso. 691, Oil and Gas Jour. 30, 19, p. 22; Oliver, Why Adequate Oil Legislation Failed in Texas, Oil and Gas Jour. 30, 18, p. 15; Sec. of Int., Work, Conservation's Need of Legal Advice, 52 Reports Am. Bar Asso. 566 (1927); 13 Am. Bar Asso. Jour. 517.

Chamberlain, Regulation of Oil and Gas, 11 Am. Bar Asso. Jour. 233; Smith, Brakes for the Mineral Industry, 53 Reports Am. Bar Asso. 655; Martin, Relative Rights and Duties of Subterranean Proprietors, 52 Reports Am. Bar Asso. 550—an exposition of property law of oil and gas; Hardwicke, Legal Aspects of Gas Conservation in Oil Production, A. P. I. Production Bulletin No. 207, p. 23, Oil and Gas Jour. 30, 6, p. 17 (6/25/31); Holliday, Oil's Legal and Economic Handicaps, Oil and Gas Jour. 29, 45, p. 34 (3/26/31). For discussion on unit operation, see Ford, Controlling the Production of Oil, 30 Mich. L. R. 1170, 1202-1209; Thomas, Changing Trend in Petroleum Economics, 55 Reports Am. Bar Asso. 703; Oliver, Oil and Gas Law Responsible for Overproduction and Waste, 55 Reports Am. Bar Asso. 712; West, Land and Lease Aspects of Unitization, A. P. I. Production Bulletin No. 206, p. 50; Swigart, Engineering and Economic Aspects of Unit Operation of Oil Fields, *Id.*, p. 79; Oliver, Program Formed for the Oil Industry, Oil and Gas Jour. 31, 1, p. 12 (5/26/32)—six-point program discussed; Lahee, Importance of Geology in New Conception of Unit Pool Development, Oil and Gas Jour. 31, 2, p. 38 (6/2/32); Oliver, Leaders Express View on Stabilization Program, Oil and Gas Jour. 31, 3, p. 24; 31, 4, p. 16 (6/16/32); 31, 5, p. 12; Farish, Problem of Preventing Waste of Oil and Gas and Stabilizing the Petroleum Industry, Oil and Gas Jour. 31, 6, p. 10; Penn, A Major Surgical Operation, A. P. I. Production Bulletin No. 207, p. 11—argues unit operation only remedy for excessive drilling; Pogue, Economic Aspects of Unit Operation of Oil Pools, Petroleum Development and Technology 1931, p. 92; Logan, Stabilization of the Petroleum Industry, *Id.*, p. 617; Beaty, Stabilizing the Oil Business, Petroleum Development and Technology 1932, p. 18; Oliver, Stabilizing Influences for the Petroleum Industry, *Id.*, p. 22; Oliver, Advantages for Unit Operation Shown, Oil and Gas Jour. 31, 7, p. 12 (7/7/32).

in common. A compulsory development program must include a provision whereby owners in the pool, collectively, shall set up their own machinery for development and determine, collectively, the policies to be pursued in the pool.⁵⁴

Nor is unit operation entirely without legal support in the cases. In Kansas a city ordinance required a permit to drill wells within the city which was located over an oil pool. Only one well was permitted in each block, to be located in the center of the block. It required that the oil be prorated between all the lot-owners in the block and required them to share prorata in the expense of production. The ordinance was held to be valid partly on the ground of fire hazard, but principally on the ground that the city had the right to regulate the production of oil from a common source of supply. After citing numerous cases the court said: "These decisions leave not the slightest doubt that the state has the power to regulate the appropriation of oil or gas from a common pool, on the ground of common ownership." The right to regulate the number of wells drilled in a given area has also been sustained. The case was affirmed by the Circuit Court of Appeals and certiorari denied by the United States Supreme Court.⁵⁵

Likewise in Venice, California, where a 2,500-barrel well was brought in in the restricted beach district, the city modified the restriction on the beach lots so as to allow one well to a block, and all lots within those blocks were required to be pooled into a community lease.⁵⁶ It may be assumed that such regulations will be sustained on the same principles that governed the decision in the Marrs case.

These instances present compulsory unit operation on a small scale. If valid here there is no reason why the principle should not be applied to a larger tract. There is this distinction that in a small tract like a city block the oil content may safely be assumed to be homogeneous. This cannot be assumed to exist in a large tract. But if the engineers from test wells can de-

⁵⁴ See valuable discussion by Oliver, *Acreage Content Standard of Ownership*, Oil and Gas Jour. 30, 22, p. 30; Oliver and German, *State Has Right to Protect Ownership*, Oil and Gas Jour. 30, 11, p. 23. For general principles and progress in unit operation, see Report IV of the Federal Oil Conservation Board 17-24 (1930).

⁵⁵ *Marrs v. City of Oxford*, 24 F. (2d) 541; 32 F. (2d) 134; 280 U. S. 563.

⁵⁶ Boyd, *Petroleum Development and Technology* 1930, 86.

termine the acreage content for a large pool it would seem to be clear that the law will not prevent unit operation.

While unit operation will minimize the physical waste and economic waste incident to drilling an excessive number of wells in one pool, and will reduce necessity for holding large scattered acreage under lease, it will not stabilize production by adjusting the same according to market demands over a state, nation, or the world. That requires co-ordination between larger units. Some central authority in the state must exist to determine the quota for each pool or producing unit with respect to the state's production as a whole. A like national authority must exist to determine the quotas for the various oil-producing states so that they may be adjusted to the national demand. And quotas determined by the national commission must be enforced by the states. Lastly, to secure the proper correlation of production quotas among nations with respect to world demand, there must be an international commission to determine the proper quota for each nation. That will require compacts between the various states and treaties between the various countries engaged in the production of oil.

The Federal Oil Conservation Board possesses only advisory powers. In his letter to the members, President Coolidge says that he has constituted the board "to study the Government's responsibilities and to enlist the full co-operation of representatives of the oil industry in the investigation" of waste and the conservation problems with respect to oil.⁵⁷

In 1920 the Federal Leasing Act was enacted by Congress. It provided for a new system of disposing of the mineral resources in the public domain with a reservation of royalties to the United States. Immediately after his inauguration, President Hoover announced that "there will be complete conservation of Government oil in this administration."⁵⁸ Acting under this instruction Secretary of the Interior, Wilbur, issued an order withdrawing the public domain from further prospecting for oil and gas and leasing. The public domain has just recently been reopened for prospecting for oil and gas and leasing,

⁵⁷ Report I of the Federal Oil Conservation Board, p. 1.

⁵⁸ Press Release No. 30582, March 13, 1929.

but only for purposes of unit operation.⁵⁹ The permit system has never operated very satisfactorily because of the speculative element injected into it. Out of 17,431 outstanding permits at the time of the withdrawal in 1929 only 3,750 have been found to have complied with the requirements for development imposed by the leasing act.⁶⁰

In order to secure the proper co-ordination between producing quotas among the various oil-producing states, a compact between the various oil states would seem to be necessary. Such compact should provide for a national committee to study the market demands and apportion the quotas among the states. The states would necessarily have to enforce these quotas themselves. The compact would therefore require ratification by the various state legislatures and must have the approval of Congress.

The first attempt to formulate such a compact occurred at the Colorado Springs conference in June, 1929. Nothing resulted from this conference.⁶¹ As a result of the Governors' conference on oil held in Washington, D. C., on January 16, 1931, an Oil States Advisory Committee was created which has since been engaged in studying the subject of an interstate agreement or compact. The first tangible result occurred when the Governors of Texas, Oklahoma and Kansas at the oil stabilization conference at Oklahoma City on September 13, 1931, signed a one-page compact agreeing to recommend the restriction of production for the rest of 1931 to a maximum daily production for Texas of 902,000 barrels, Oklahoma 546,000 and Kansas 110,000, and pledging themselves to continue thereafter to co-operate to this end to the extent of their ability. This compact has received the informal adherence thereto by California, New Mexico, Colorado and Wyoming.⁶²

⁵⁹ 5 So. Cal. L. Rev. 355, 390; see 377 for amendment to leasing act to permit unit operation. Public Domain Open for Oil Under Unit Operation Plan, Oil and Gas Jour. 30, No. 47, p. 24 (April 7, 1932).

⁶⁰ Oil and Gas Jour., note 48, *supra*.

⁶¹ 5 So. Cal. L. Rev. 355, 390.

⁶² Ames, Interstate Compacts Vital, Oil and Gas Jour. 30, 25, p. 14; Kern, Annual Report submitted by Secretary Wilbur to Congress, Oil and Gas Jour. 30, 30, p. 15 (Dec. 10, 1931). For recent developments with respect to interstate compacts see Marshall and Meyers, Legal Planning of Petroleum Production: Two Years of Proration, 42 Yale L. J. 702, 732, notes 101 and 102.

Secretary Wilbur has been a constant supporter of the compact theory.⁶³ And Secretary of Commerce, Lamont, in an able address before the American Petroleum Institute at its annual meeting in Chicago in November, 1931, has unqualifiedly supported Secretary Wilbur's program.⁶⁴ Since the Federal Oil Conservation Board is composed of these two secretaries, together with the Secretaries of War and Navy, the oil industry can be assured of the most valuable co-operation on the part of

⁶³ Wilbur's program includes: 1. An adequate conservation agency in each state, enforcing within its boundaries conservation laws uniform in principle with those of other major producing states. 2. An interstate advisory board constantly studying supply and demand and fixing periodic quotas for production by the various states. 3. An interstate compact under which the states agree to appoint this committee and enforce these quotas, and at the same time agree on uniform practice of conservation. 4. A joint federal and state participation in negotiation with governments of foreign production quotas to correspond with our own, so that conservation here would not be followed by excessive importations or undue loss of export trade. 5. Some form of federal protection for the consumer. 6. Congressional sanction of these steps. *Oil and Gas Jour.* 30, 34, p. 68 (Jan. 7, 1932); *ibid.* 30, 30, p. 15 (Dec. 10, 1931).

⁶⁴ Lamont says: "During the past five years a new movement has taken form in the oil industry. That movement is the plan for co-operation between the producing states." He further states that "in April of this year the Oil States' Advisory Committee, appointed by the governors of ten states, laid before the Federal Oil Conservation Board a program calling for an agreement among the oil producing states under which each state, while retaining administration of its own resources, would enact uniform conservation laws, co-ordinate their enforcement with those of other states, and co-operate through an interstate advisory board, which would balance state production quotas and help in the correlation of such quotas with foreign production. The Federal Oil Conservation Board gave its formal approval; such a program was directly in line with its own efforts." He stresses the necessity of three measures. "This three-point program—co-ordination of state production by an interstate compact, uniformity of conservation principles by a compact or otherwise, and equation of foreign and domestic production by a joint federal state board created by the compact—can be accomplished just as quickly as necessity demands." *Oil and Gas Jour.* 30, 26, p. 23 (Nov. 12, 1931); see also Stanley, *The Drama of the Oil Industry—Calling for Federal Regulation*, 56 *Reports Am. Bar Asso.* 669; Draft for proposed Federal law, *id.*, 678; *Oil and Gas Jour.* 30, 18, p. 24. Ford, *Controlling the Production of Oil*, 30 *Mich. L. R.* 1170, 1210-1223, argues that federal control can be constitutionally exercised through either the commerce, taxing, or treaty powers. Fuchs, *Legal Technique and National Control of the Petroleum Industry*, 16 *St. Louis L. Rev.* 189. Hardwicke, *Limitation of Oil Production to Market Demand*, *Oil and Gas Jour.* 31, 20, p. 54 (10/6/32); Ely, *Co-operation of States in Production and Conservation of Oil*, *Oil and Gas Jour.* 31, 21, p. 48 (10/13/32). Kern, *Federal Oil Board Warns Industry to Meet Its Problems*, *Oil and Gas Jour.* 31, 22, p. 10 (10/20/32); German, *Oil Industry's Case for Conservation*, *Oil and Gas Jour.* 31, 22, p. 14 (10/20/32). Bruce, *The Oil Cases and the Public Interest*, 19 *Am. Bar Asso. Jour.* 82, 168.

the federal government in solving the oil conservation problem of the several oil-producing states.

At the last meeting of the American Bar Association it was resolved that its Committee on Conservation of Mineral Resources co-operate with other agencies in the preparation of an interstate compact and also in the effort to develop a standard for unit operation.⁶⁵ A bill providing for an interstate compact was introduced at the present Congress by an Oklahoma Congressman.⁶⁶

FOREIGN COMPARISONS

The conservation problem with respect to oil and gas is so recent that little, if any, has come into print dealing with foreign oil fields. A great deal has been written on the oil problem generally, dealing mostly with the acquisition of concessions and diplomatic correspondence relative to oil controversies.⁶⁷ Nor is the conservation problem so acute in foreign countries as in the United States. Nowhere has production been so intense as in our own country. While we possess about 18 per cent. of the world's oil resources, we have for years pro-

⁶⁵ The resolutions pertinent to oil are: 2. That this committee be authorized to co-operate with the Oil States Advisory Committee and the Federal Oil Conservation Board in the preparation of an interstate compact in such other plan as may seem feasible for the stabilization of the petroleum industry. 6. That this committee be authorized to co-operate with committees of engineers in the effort to develop standards for the unit operation of oil pools. 56 Reports Am. Bar Assn. 648 (1931).

At the last annual meeting of the American Petroleum Institute a committee of eleven was appointed to prepare and recommend a comprehensive program designed to put unit operation into effect. The committee has not yet reported. Production Bulletin No. 208, p. 24 (1932).

⁶⁶ Oil and Gas Jour. 30, 46, p. 28 (3/31/32). An interstate compact measure, proposed by the Oil States Advisory Committee and submitted by Senator Thomas of Oklahoma, is also before the Senate Committee. It limits oil imports to 5½ per cent of domestic consumption. Oil and Gas Jour. 31, 1, p. 13 (5/19/32).

⁶⁷ Arnot, *The Politics of Oil* (1924); Davenport and Cooke, *The Oil Trusts and Anglo-American Relations* (1924); De La Tramerye, *The World Struggle for Oil* (1923); Mohr, *The Oil War* (1926); Louis Fischer, *Oil Imperialism* (1926); *Oil Concessions in Foreign Countries* (American diplomatic correspondence). Brokaw, *Oil*, 6 Foreign Affairs 89 (1927); Lee, *Race for Oil in Venezuela*, 51 *World's Work* 148 (Dec., 1925); N. Y. Times, p. 4XX (11/20/29); Wilson, *Oil Legislation in Latin America*, 8 Foreign Affairs 108 (1929); Oil and Gas Jour. 10/10/29, p. 56; National Petroleum News 8/28/29, p. 62.

duced and consumed two-thirds of the world production.⁶⁸ Nowhere has competitive development been equaled to that in the United States and, as a consequence, nowhere have conditions existed which is productive of waste on so large a scale as in our own country. So much of the foreign production comes from non-competitive oil fields, where concessions have been granted to a single company and where consequently unit operation can be employed, that the oil conservation problem is essentially one confined to this country.

In 1928 the United States production under unit operation was negligible, while 55 per cent. of foreign production came from unit-operated fields.⁶⁹ Later figures have given foreign production from unit operation at 60 per cent. In this country at this time there are fields operated on what may be termed near-unit operation where lessces operate under agreements. Typical of this is the Sale Creek field in Wyoming. But the only examples of completely unitized fields are to be found in Persia, India, Dutch East Indies, Mexico and South America. Here the mineral rights are owned or controlled by the government, and a single operator has secured a concession from a single lessor.⁷⁰ The United States is now in a position to have the public domain developed under unit operation, but as 90 per cent. of the oil in this country is derived from private lands this will not go far towards solving the conservation problem.

The principal competitive foreign fields are those bordering on the east shore of Lake Maracaibo in Venezuela. But the Mene Grande field in that group, and one of the greatest fields in the world, is operated by one company and is said to be "one

⁶⁸ World production in 1929 in millions of barrels: United States, 1,006.7; Venezuela, 138.9; Russia, 98; Mexico, 44.7; Persia, 43; Dutch East Indies, 36; Rumania, 33; Columbia, 20.4; Peru, 12.5; Argentina, 10; Trinidad, 8.7; India, 8.3; Sarawak (West Borneo), 5.3; Poland, 4.7; Japan, 2; Egypt, 1.9; Sakhalin, 1.2; Canada, 1.1; Ecuador, 1; Germany, .7; Irak, .5; France, .5; Czechoslovakia, .17; Italy, .043; Others, .022; World 1,479.335—*Carlias, Petroleum Development and Technology* 1930, 552.

World production for 1931 estimated: United States, 856; Russia, 158; Venezuela, 118; Rumania, 48; Persia, 47; Dutch East Indies, 39; Mexico, 34; Columbia, 18; Peru, 11.5; Trinidad, 10; Argentina, 10; India, 8; Sarawak, 5; Poland, 4.4; Japan, 2; Sakhalin, 2; Ecuador, 1.7; Egypt, 1.8; Canada, 1.7; Germany, 1.2; Irak, .8; Others, .9; World total, 1,379—*Oil and Gas Jour.* 30, 21, p. 81 (Oct. 8, 1931).

⁶⁹ *Petroleum Development and Technology* 1930, p. 13.

⁷⁰ *Production Bulletin* No. 206, p. 86, American Petroleum Institute.

of the finest examples of efficient oil production to be found anywhere." Production in this field in 1928 or 1929 was 15 million barrels.⁷¹ Another example of efficient unit operation is the Masjid-i-Suleiman (Temple of Solomon) pool in Persia, a field twenty miles by four miles and operated as a unit by the Anglo-Persian Oil Company.⁷² Colombia has two producing fields operated by single companies. Almost the entire production comes from them. In Peru production is controlled by two companies. In Ecuador all oil is produced by one company. Bolivia has no production, but two American oil companies hold large concessions. In Argentina all important fields are competitive. In Trinidad some smaller pools are operated as units and in competitive pools there are large consolidated blocks operated by single companies. The government discourages competitive drilling by prohibiting the drilling of wells within 150 feet of the boundary of a property and encourages centralized operations in the different areas by setting up spheres of influence around newly developed leases.⁷³ Nearly all unit foreign operations are on concessions or leases granted to a single company.⁷⁴ In Mexico one company operates two pools, estimated to produce in 1929 seven million barrels, located on the

⁷¹ Petroleum Development and Technology 1930, pp. 13, 100, also at 19.

⁷² Sir John Cadman, president of the company, says with respect to the operation of this field: "To secure the production of crude required for export all that has to be done now is to open the necessary valves by means of which the production of crude can from day to day or from hour to hour be regulated to our requirements to a nicety, just as regularly and as accurately as when one turns on the water for one's bath." Production Bulletin No. 204, p. 31. Compare this with the competitive operation in the Glenn pool in Oklahoma in 1909, where it was said that more waste oil flowed away into the creeks than has been produced in the State of Illinois; and the Healdton pool, 1913; and Cushing pool, 1914, both in Oklahoma. In these, hundreds of thousands of barrels of oil were stored in earthen pits by those compelled to produce but without facilities to handle the oil and which was washed away in floods. Similar wastes occurred in the Spindletop pool in Texas and in the Smackover pool in Arkansas. German, Legal Aspects of Equitable Extraction and Distribution of Recoverable Oil, Production Bulletin No. 208, A. P. I., 15. Oil and Gas Jour. 30, 26, p. 34 (11/12/31); Oliver and German, State Should Equalize Oil Production, Oil and Gas Jour. 30, 14, pp. 19, 101 (8/20/31).

⁷³ Hill and Estabrook, Unit Operation in Eastern United States and in Foreign Countries, Petroleum Development and Technology 1930, p. 20.

⁷⁴ *Id.*, 17.

Isthmus of Tehuantepec. In Venezuela in addition to the Mene Grande, already noted, the El Mene is unit operated.⁷⁵

In Europe unit operation prevails in France at Pechelbronn. Germany is competitive. Italy has four small producing fields operated by single companies, and all developed as units under concessions. However, in Rumania all producing fields are developed on competitive basis and all in small lots of from two acres to one hundred acres. Poland has been highly competitive. In Russia all fields are now operated by the Soviet Government. Each sand is developed separately by drilling rows of wells around the entire pool and and drilling new rows towards the center of the field as the edge wells become exhausted. The two principal fields are Baku and Grozny, which produced nearly 85 million barrels in 1928 out of a total production of less than 87.5 million barrels.⁷⁶

All Persian oil fields are operated by one company and operated under the most efficient unit system of production and restricted to market demands. Irak has an important potential production but no present outlet for oil.⁷⁷ Since the Irak Petroleum Company holds the entire concession, it will be operated as a unit when production will begin. At present a twelve-inch pipe line is being constructed to the Mediterranean Sea, a distance of 700 miles, which line it is expected will be completed in 1935. It reaches two points on the Mediterranean, and the line will be in the form of a "Y," with a total length of 1,200 miles.⁷⁸ In India, Assam and Punjab have several pools operated by one company, but Burma produces about seven-eighths of the oil in India. In the Dutch East Indies there are several fields operated by a single company and all oil comes from fields operated as units. Japan is all under unit operation, as is likewise Sakhalin. Egypt is developed by a single company.⁷⁹

⁷⁵ *Id.*, 19.

⁷⁶ *Id.*, 20-21.

⁷⁷ Cox, *Irak and Its Oil Fields, Petroleum Development and Technology* 1932, p. 238. Three principal pools—Kirkuk and Qaiyarah about 185 miles north of Baghdad will be operated by the Irak Petroleum Co. with pipe line outlet to the Mediterranean, and Naft Khanah pool near the Persian border is operated by the Anglo-Persian Oil Co.

⁷⁸ *Id.*, 21; *Oil and Gas Jour.* 30, 44, p. 15 (3/17/32).

⁷⁹ *Petroleum Development and Technology* 1930, 21-22; and see *id.*, 552-583 on foreign production generally.

The outstanding contribution to unit operation in the United States comes from California in the plan of development now established for the North Dome of the Kettleman Hills. This field is on government land, and unit operation was only made possible by an amendment to the leasing act increasing the acreage which may be included in leases. Here the Kettleman North Dome Association controls the unified operation and development of 10,800 acres, and the Standard Oil Company of California will operate another unit of 9,460 acres.⁸⁰

No significant developments in foreign oil production occurred in 1930. Peru granted a concession to one Davis for building a railroad 800-900 kilometers across the Andes. This carried with it another concession to twelve and one-half million acres of land with oil and mineral rights.⁸¹ At the close of 1930 Colombia was considering a new petroleum law. This was enacted as Law No. 37 in 1931. It provides in substance that tracts of 5,000 to 100,000 hectares may be acquired by a concessionaire with a limit of 200,000 in certain areas. A security deposit of \$1.00 per hectare with a minimum of \$25,000 is required on government grants, and is returned to the concessionaire upon full compliance with the law. Rentals increase progressively from 10 cents per hectare per year for first two years to 50 cents per hectare the sixth year, and are required up to the commencement of the production period. Concession runs for 30 years from the beginning of production and may be extended for 10 years at option of contractor. Wells must produce at not less than 25 per cent. of their maximum capacity. Royalties vary from 2 to 11 per cent. of the gross output, depending on distance from port of loading. Petroleum from private property is subject to government tax from 1 to 8 per cent. of gross product, depending on the distance of the property from the coast. Royalties or taxes on oil are payable in money or in kind at port of loading. These are also payable on petroleum condensate and natural gas marketed from national or private lands. Pipe lines and refineries may be constructed and transportation tariff schedules on pipe lines are fixed by the

⁸⁰ Petroleum Development and Technology 1931, 80.

⁸¹ Petroleum Development and Technology 1931, 516.

government in conjunction with the operators.⁸² One novel feature of the Colombia oil law is the placing of a tax of one cent per 1,000 cubic feet on the natural gas wasted.⁸³ Almost the entire production here is by the Tropical Oil Company. All operations are unitized and all gas not used for operations is returned to key wells for repressuring the field.⁸⁴

In Russia there is a constant increase in production under the five-year plan. Lack of transportation facilities is the chief drawback to further increase. Baku is a very old oil field. It has been extensively over-drilled and is consequently not unitized. This field and Grozny are the present producing fields. But the Maikop and Kuban fields in the North Caucasus have indications of being one of the most important potential reserves of the world.⁸⁵ Baku on the Caspian and Batum on the Black Sea are now connected with eight- and ten-inch pipe lines.⁸⁶

Rumania increased its production in 1930 by six million barrels over that for the preceding year. The law of 1930 prohibits bailing and requires that all wells which stop flowing naturally shall be produced either by air-lift or gas-lift or pumping. The new mining law makes it obligatory to collect all gases produced with the oil and to extract the liquefiable products before delivering the gas for combustion purposes. Competitive drilling has been at its worst in Rumania. Under the new mining law, the subsurface rights for most of the undeveloped land belonging to the government, the average size of a lease is from 20 to 40 acres. But in areas where the landowner retains his subsurface rights the law requires that such land be incorporated in a larger block for leasing purposes. A minimum distance of 260 feet is required between offsetting wells and 130 feet from the lease boundary. Wells with too high gas-oil ratio are shut in to protect gas pressure being lost. Among the three leading oil companies unit operation prevails. Some of the gov-

⁸² Wheeler, *Petroleum Development in Columbia in 1931*, *Petroleum Development and Technology* 1932, p. 261. See discussion *Oil and Gas Jour.* 30, 20, p. 14 (10/1/31).

⁸³ *Id.*, 520.

⁸⁴ *Id.*, 518.

⁸⁵ Zavoico, *Russian Oil Fields in 1929-1930*, *Petroleum Development and Technology* 1931, 539.

⁸⁶ Beckstrom, *Russian Oil Fields in 1930-1931*, *Petroleum Development and Technology* 1932, p. 221.

ernment leases carry with them the obligation for wildcat drilling in areas far remote from present proven territory or from leased acreage.⁸⁷

In South Sumatra most of the producing oil concessions were granted under the old law prior to 1918 and run for a period of seventy-five years. This law was superseded by regulations which went into effect that year, and since then no concessions have been granted except by special government legislation. Some concessions were granted on the basis of the government's participation in the profit. Mining and prospecting permits have been granted since 1918 in large numbers but they have little or no commercial value since there are prohibitive restrictions which practically prevent the economic production of oil and gas. Where properties can be operated on concessions granted under the old mining law, the taxes and royalties on production are reasonable.⁸⁸

The Singu field in Burma is an outstanding example of orderly and conservative exploitation. Development in general is carried out from the flanks towards the top of the structure with a careful regard for pressure control. Every possible measure is taken to avoid excessive gas-oil ratios. Wells in which the production of gas is excessive are shut down. Since prospects for new petroleum resources in India are limited, the principal operating companies have adopted policies of conservative development of known accumulations, and the present stabilized output bears every prospect of a long continuance.⁸⁹

The Petroleum Production Act of 1918 was enacted by Parliament when it was believed that petroleum might be found in commercial quantities within the United Kingdom. That expectation has proved disappointing. The act simply makes provision for licensing any person who desires to search or bore for petroleum within the United Kingdom. The licensing provision is not applicable to agents of the Crown.⁹⁰ In this

⁸⁷ Gardescu, *Petroleum Development in Rumania During 1930*, *Petroleum Development and Technology* 1931, 552.

⁸⁸ Ely, *Petroleum in the Dutch East Indies*, *Petroleum Development and Technology* 1931, 559.

⁸⁹ Bradshaw, *Petroleum in the Indian Empire*, *Petroleum Development and Technology* 1931, 569.

⁹⁰ Stat. 8 and 9 Geo. V (1918), ch. 52.

respect the act is like our own leasing act, which requires every prospector for oil or gas upon the public domain to obtain a permit from the Secretary of the Interior.